
CHAPTER 7

ERGONOMICS

EMPLOYEES AND THEIR WORK ENVIRONMENT

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7.00 INTRODUCTION

“Ergonomics” is defined as the study of physical and behavioral interaction between humans and their environment.

This chapter discusses ergonomics in relation to methods used and the proper selection and use of furniture and equipment to reduce personal injury and occupational illnesses.

7.01 PURPOSE

Introduces and promotes an ergonomic program in which the work environment and equipment are compatible with the physical characteristics of the employee.

7.02 POLICY STATEMENT

It is Caltrans policy to maintain an effective ergonomic program by selecting furniture and equipment, and arranging workstations to reduce health risks and personal injury in the workplace.

7.03 DEFINITIONS

Administrative Controls -- Includes efforts to redesign workstations, adjust workspace, change work assignments and change work schedules or work duties to accommodate the employee's unique needs. When a workstation is redesigned or changed, the employee may need additional training to properly adjust to the changes.

Cumulative Trauma Disorder (CTD) -- A CTD is a personal injury caused by repetitive motion and develops from or is aggravated by cumulative stress to tissues and joints.

CTD Risk - The presence of work activity factors such as:

- **Frequency** -- The rate at which specific physical motions or exertions are repeated.
- **Force** -- Physical exertion by or pressure applied to any part of the body.
- **Duration** -- The length of a period of work which poses a CTD risk.
- **Posture** -- The position of a body part during work activity.
- **Exposure** -- Exposure to cold temperatures that cause discomfort to localized or whole- body part, including hands and feet.

Engineering Controls -- Includes devices such as adjustable workstations, tables, chairs, equipment, keyboard, and tools; or physical modifications to workstations, equipment, tools, and/or production processes.

Personal Protective Equipment (PPE) -- Items worn on or attached to the body for protection; e.g., cloths, padding, gloves, or devices, etc.

Visual Display Terminal (VDT) -- Any device or set of devices used with a keyboard and cathode ray tube or other electronic device for entry or display of data, words, numbers, and symbols.

VDT Operator -- An employee who routinely works at a VDT.

7.04 WORKSITE EVALUATION

Each employee has unique physical characteristics, i.e., height, weight, reach, strength, sight, and hearing. An employee also has individual work methods and style and sometimes unique ways of performing a task, such as lifting techniques.

Worksite evaluations take the physical characteristics of employees into consideration and attempt to match employees to their work activities through the use of ergonomic principals.

The objective of worksite evaluations is to identify health risks in the workplace. Supervisors should look for repetitive work activities that can put employees at risk for a CTD.

The following includes some of the high-risk activities that are likely to cause CTDs and require evaluation:

- Repeated use of the same tool or similar tools;
- Repetitive keystroking, which consists of manually striking or pressing a data-entry device such as a keypad or button;
- Repetitive processing of items;
- Routine use of a mechanical or electronic device; e.g., chainsaw, hand drill, power tools;
- Repetitive motions and exertions that may cause fatigue of the body parts performing the activity;
- Presence of vibration while performing repetitive activity;
- Performance of a repetitive activity while fingers and toes are exposed to extreme temperatures.

When performing repetitive activity, it is essential to identify each task separately to ascertain which are the most hazardous and how to eliminate or reduce the risk associated with the task.

The supervisor shall investigate any employee allegations of discomfort associated with their work, workstation, equipment, tool, new product, or new operation.

7.05 CONTROL INTERVENTIONS

Control interventions are methods and strategies that can be introduced into the workplace, work activity, or process to reduce CTD risk. These can include lowering or raising worktables; reorganizing the work process; and reducing hand forces. Supervisors, with the assistance of the safety and health staff, should consider using control intervention whenever possible.

Administrative controls consist of reviewing proper work practices, correctly matching workers to job demands, and additional job considerations. The disadvantage of administrative controls is that they treat symptoms and not the cause of ergonomic problems.

PPE for use in ergonomic situations is very limited. Splints, for example, shall not be used unless under the advice of a licensed physician or chiropractor. Back belts or lumbar supports are other PPE used in ergonomic situations require approval by a licensed physician or chiropractor.

7.06 WORK AREA DESIGN

Work areas should be based on body dimensions using the following principles:

- **Head Height** -- allow for tallest worker and natural posture;
- **Elbow Height** -- adjust normal work surface to just below elbow height;
- **Arm Reach** -- allow for shortest employee when reaching up or out; allow for tallest worker when reaching down;
- **Leg Length** -- allow for long legs; provide adjustment or footrests for shorter legs; and
- **Body Bulk** -- allow for largest worker (consider varying girth and clothing bulk).

7.07 WORKING HEIGHTS AND CHAIRS

Inappropriate working heights and chairs are the most common problems in workstation design.

The most favorable working height for handwork while standing is two to four inches below elbow level. On average, working heights of 37 to 39 inches for men and 35 to 37 inches for women will be convenient. In addition to an employee's physical characteristics, the nature of the work must be allowed for as follows:

- For detailed work (e.g., drawing), it is desirable to support the elbow; and
- For standing work, if it involves much effort and makes use of the upper part of the body (e.g., mailing/file handling), the work surface should be lowered to from six to 16 inches below elbow height.

It is important to remember that one chair size will not fit all of your employees. The following guidelines will help ensure the best match between chair and worker:

- Office chairs must be adapted to both the traditional office job and the modern equipment at VDT workstations;
- Chairs must accommodate both forward and reclined sitting postures;
- Backrests should have adjustable inclinations and it should be possible to lock inclinations at desired positions;
- Backrests should have adjustable height and well-formed lumbar supports;
- Seat surfaces (seat pans) should have adjustable depth and width that is suitable for the individual; and
- Chairs must have adjustable arms and height, swivel, rounded front edges, casters or glides, five-leg bases, and user-friendly controls.

7.08 LIGHTING

Glare is the reflection on your VDT screen that makes it difficult to see the screen clearly. Glare can be caused by sunlight on your screen or by inside light. Simple lighting adjustments can help minimize and reduce eyestrain and headaches.

- Position VDT screens so they are at a right angle to any windows producing glare;
- Close shades, curtains, or blinds, if necessary, as light changes during the day;
- Tilt VDT screens down slightly to avoid overhead lights from producing glare;
- Sit with ceiling lights at sides rather than directly overhead;
- If a task lamp is used, position it so that light is aimed at documents and not at VDT screens;
- To help improve viewing comfort, the display screen's contrast and brightness moods may also need to be adjusted;
- Periodically clean display screens to maximize clarity;
- Font characters on display screens should be clear, stable, and free from perceptive flicker; and
- VDT screen glare shield attachments should be considered if glare elimination is not adequate through the foregoing measures.

7.09 BACK CARE, SAFE LIFTING, AND BACK BELTS (LUMBAR SUPPORT)

Lifting is the most common task associated with low-back injuries. Back injuries are commonly caused from overexertion, either sudden or cumulative. The most effective means of minimizing back injuries is through training on proper lifting techniques.

The following techniques should help reduce the risk of low-back injury:

Before You Lift

- Always warm up before you lift any load to prevent muscle strains and pulls; and
- Stretch your back with upward reaches and continue to loosen tight muscles with simple side and back bends.

Lifting Safely

- Use mechanical assistance whenever possible.
- Roll, push, or pull the object to its destination;
- Redesign the task to eliminate lift;
- Let your abdomen, legs, and buttocks do the work;
- Get close to the load. Grab the load safely with your hands placed under the object;
- Bend your knees, with feet slightly spread, for balance and stability;
- Keep your head, shoulders, and hips in a straight line as you lift;
- Do not twist;
- Reverse these steps when you set a load down. Move slowly and smoothly without twisting;
- To change direction of carry, do not twist. This is crucial when doing repetitive lifting. Turn your entire body, including your feet;
- Stand before you lift. Never lift from a sitting position. Sitting puts more pressure on the spine;
- Push rather than pull a load; and
- Acknowledge when an object is too heavy for one person to lift, and get help.

Keep the Path Clear

- Look at the move before you lift and clear the path you plan to follow;
- If you can't see over the load, don't carry it;
- Use mechanical help (pushcart, handtruck, wheelbarrow) if the load is heavy or bulky; and
- Know where the load/item is to be placed.

SPECIAL NOTE ABOUT BACK BELTS:

It is departmental policy that back belts **shall not be purchased** as PPE. The National Institute for Occupational Safety and Health (NIOSH) does not recommend the use of back belts to prevent injuries among **uninjured** workers, and does not consider back belts to be PPE. NIOSH further concludes that there is insufficient data indicating that typical back belts significantly reduce the biomechanical loading of the body (trunk) during manual lifting.

Additionally, there is insufficient scientific evidence to conclude that wearing back belts reduces risk of injury to the back based on changes in abdominal pressure and trunk muscles, and the use of back belts may produce temporary strain on the cardiovascular system.

Back belts may be purchased only for employees who have a doctor's prescription specifically indicating that the employee should use a back belt for specific work activities.

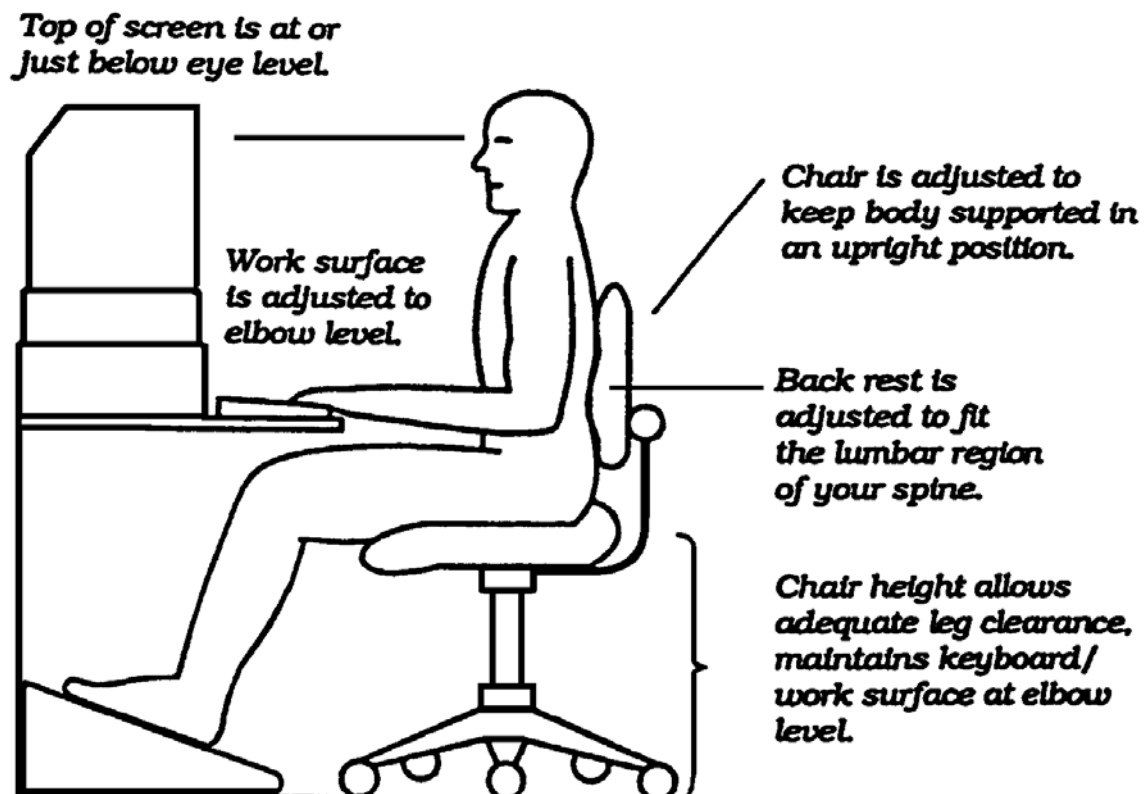
7.10 WORKSTATION DESIGN ILLUSTRATIONS

The workstation design in the Appendices provides guidelines that promote safe workstations for employees who work at VDTs. These illustrations cover most principals of ergonomics necessary for workstation design and personal comfort.

Proper VDT use, including proper posture and workstation adjustments with careful attention to muscle and eye fatigue, will help prevent musculoskeletal and visual problems.

APPENDIX A-ADJUSTING YOUR CHAIR AND WORKSTATION

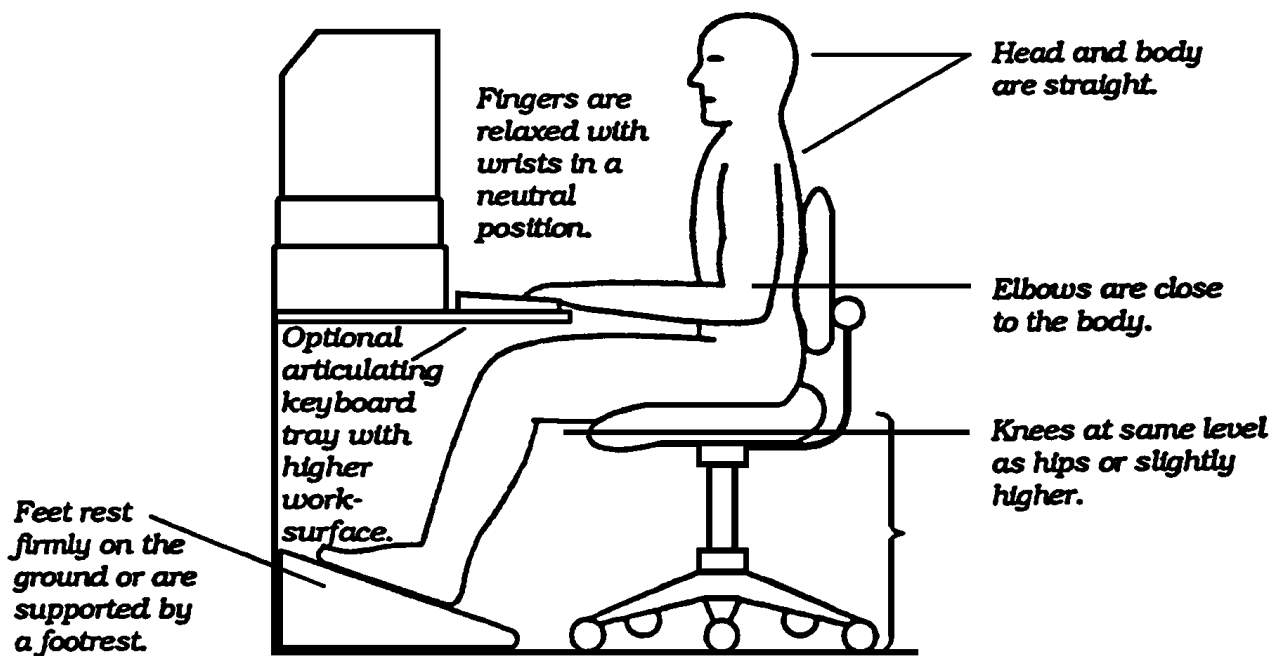
- Adjust lumbar (lower back) support by moving the backrest up or down to match the inward curve of your spine.
- Adjust the tilt of the backrest and/or seat to keep your body supported in an upright position.
- Adjust the seat height for adequate leg clearance under the workstation and to keep the keyboard at approximately elbow level.
- Adjust your monitor so that the top of the screen is at or just below eye level and is a viewing distance of between 18 and 24 inches.
- Use a document holder that places the documents at the same height as the monitor.



Note: Reassess your workstation periodically.

APPENDIX B- PROPER BODY POSTURE

- Keep your head in line with your shoulders and hips;
- Keep elbows close to your body;
- Keep wrists in a neutral position; bent no more than ten degrees up or down;
- Keep your knees at the same level as your hips or slightly higher;
- Keep feet flat on the floor or supported by a footrest;
- A keyboard for fixed work surfaces and padded wrist rests can be used to help support the wrists in a neutral position;
- Keep fingers in a relaxed position when working; and,
- Avoid extreme finger extensions.



Note: Reassess your body posture periodically.

APPENDIX C-WORKSTATION LAYOUT

